Acquisition of a Scanning Probe Microscope for Liquids Materials Research and Student Training, p. 1

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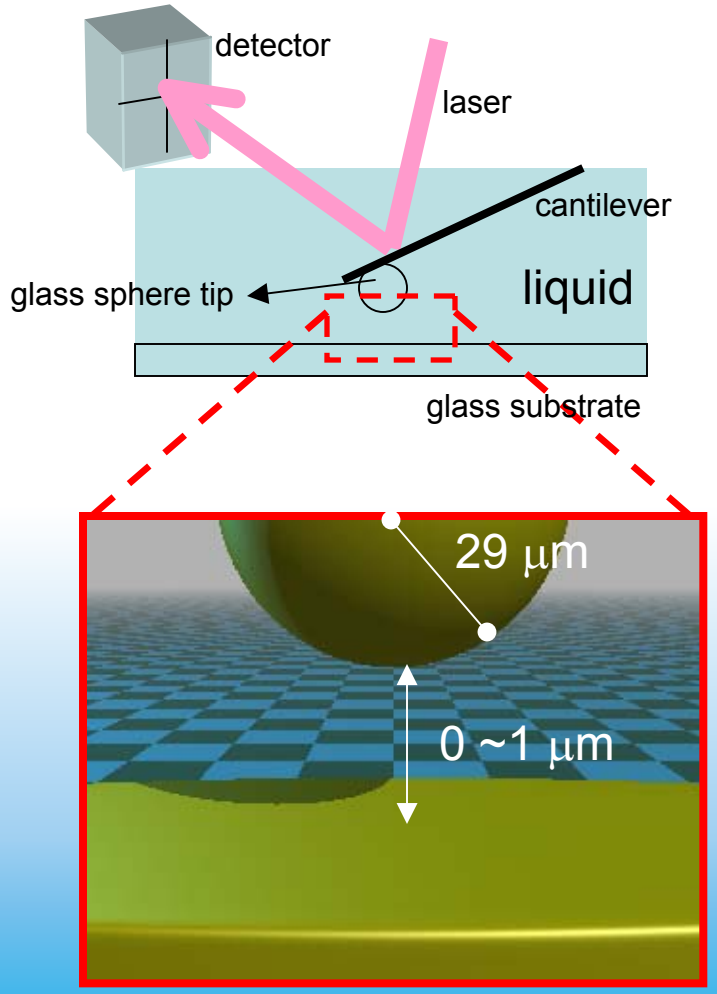
In the nanotechnology revolution, as the system size decreases, surface effects will become more and more important. Thus, at small length scales within nanometers of a surface, the surface interactions will structure and influence both the statics and dynamics of liquids in the immediate vicinity of a solid surface. A topic of considerable current interest, especially in micro-/nano-sized systems, has been determining the solid and liquid properties which govern the boundary conditions that exist at the liquid/solid interface during fluid flow. Such a topic is of particular interest, for example, in capillary fluid flow where the flow boundary conditions may considerably influence the flow rate (eg. through your blood vessels). A 'colloidal probe' Atomic Force Microscope (AFM) can study the presence of slip at the solid/liquid interface by measuring the hydrodynamic force that acts between a glass sphere, attached to the AFM cantilever, as it rapidly approaches a solid surface while immersed in a liquid.

Atomic Force Microscope



Acquisition of a Scanning Probe Microscope for Liquids Materials Research and Student Training, p. 2

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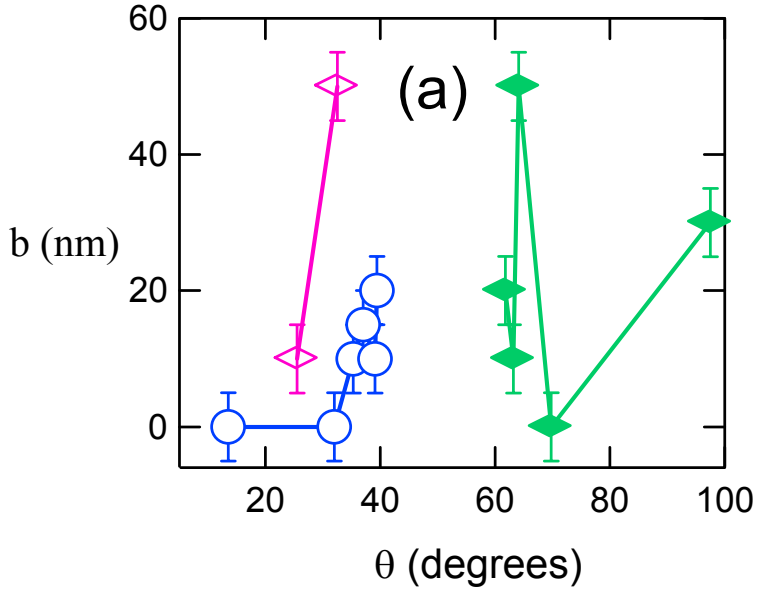
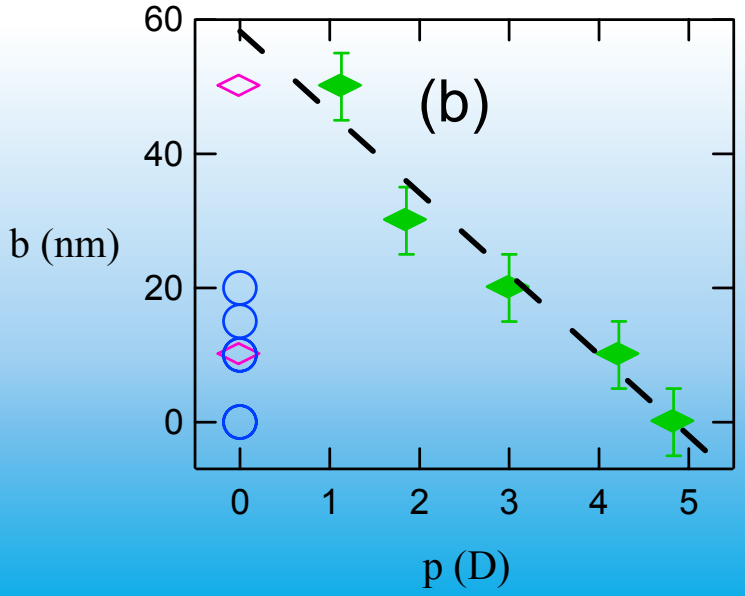
Educational:
Two graduates and one postdoctoral research associate have been involved in research related to scanning probe microscopy.





(a) Measured slip lengths b against liquid contact angle θ for various liquids. For non-polar liquids (pink and blue symbols), as the contact angle decreases and the surface becomes more wettable, the slip length decreases and approaches a no-slip boundary condition (corresponding to b = 0), as expected. Surprisingly, for polar liquids possessing a large contact angle (green symbols), there is no apparent correlation between slip length and contact angle.

(b) Instead we find that the slip length for polar liquids seems to depend primarily upon the dipole moment p of the liquid.